Income-Related Biases in International Trade: What Do Trademark Registration Data Tell Us?

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Abstract: Economists have long recognized that richer countries trade more among themselves than with poorer economies due to a closer match of exporter supply structures and importer preferences. In the literature, the closeness of supply and demand has traditionally been determined by the quality of products—as expressed in the so-called Linder hypothesis. This paper examines an extension of the Linder hypothesis by also considering the extent of horizontal product differentiation as another determinant of the closeness of supply and demand. The empirical analysis employs information on international trademark registrations to test whether richer countries tend to import more from countries whose exports are of higher quality and exhibit a greater degree of product differentiation. The results lend support to the hypothesis in most consumer goods sectors but not in intermediate goods sectors.

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I. Introduction

Economists have long recognized that richer countries trade more among themselves than with poorer countries due to a closer match of exporter supply structures and importer preferences. Traditionally, the factor that determines the closeness of supply and demand has been the quality of products. Linder (1961) first pointed out that richer countries are likely to spend a larger share of their income on higher quality products. At the same time, more developed economies are likely to have a comparative advantage in producing high quality goods. Hence, one would expect production in the rich world to match more closely consumption in the rich world, thus leading to relatively more trade among developed nations.

A number of authors have formalized and extended Linder's analysis of the role of product quality in trade. In Murphy and Shleifer's (1997) Ricardian trade model, the key variable determining both a comparative advantage in producing high quality products and a taste for high quality goods is a country's endowment of human capital. Falvey and Kierzkowski (1987) develop a model whereby demand for high quality products increases with consumers' income and analyze how trade patterns are determined by cross-country differences in capital and labor endowments, production technologies and income distribution.[1]

Few empirical studies verify the predictions of the theoretical literature. Applications of the gravity model of bilateral trade have attempted to take into account the Linder hypothesis by adding the absolute difference in trading partners' per-capita GDPs as an additional explanatory variable in the regression equation (see Leamer and Levinsohn, 1995). The most careful study to date, Hallak (2001), develops a model of import demand that explicitly allows for cross-country differences in consumers' preference for quality and estimates it using bilateral trade flows at the sectoral level. Differences in the quality of countries' exports are captured by a quality index based on cross-country differences in unit values of US imports at the 10 digit Harmonized System level. The study confirms that richer economies indeed import more from countries exhibiting a higher value of the quality index.

[1] Further theoretical research on the trade and quality nexus can be found in Flam and Helpman (1987) and Stokey (1991).

However, a closer match between exporter supply structures and importer preferences may not only be due to product quality. Exporters often horizontally differentiate their products and employ various forms of marketing to influence consumer preferences in the importing country. If richer countries specialize in the production of more differentiated products—as in the Helpman-Krugman trade model—and consumers in richer countries have a more pronounced taste for such products, trading patterns will, inter alia, be biased towards trade among developed nations.[2] In addition, one would expect high quality production to be associated with horizontal product differentiation, reinforcing the traditional Linder hypothesis.

This is the first study to use detailed data on international trademark registrations to test for such income-related biases in international trade. This novel approach has two distinct advantages. First, firms' propensity to seek out trademarks for their products is likely to be a good indicator of both product quality and the extent of product differentiation. As explained below, high quality and marketing-intensive producers face a higher risk of imitation and, therefore, tend to rely to a greater extent on the protection provided by the trademark system.

Second, the use of trademark registration data can overcome some of the drawbacks of existing empirical research on the Linder hypothesis, which employs information on unit values. Cross-country differences in unit values of imports can be due to quality but can also result from other considerations, such as differences in mark-ups between countries, discounts for large quantities, buyer monopsony, as well as transport costs. Even at a very disaggregated level unit values can suffer from the problem of aggregating dissimilar products. Moreover, unit values may not accurately reflect quality as cross-country differences in relative costs can make countries price differently goods of the same quality. Further, since countries may record quantities less accurately than they record the value of trade, unit values may suffer from a measurement error and thus a regression analysis using them as an independent variable (as is necessary in testing the Linder hypothesis) may lead to inconsistent estimates. Finally,

[2] Hummels and Klenow (2002) find that up to two-thirds of the expanded trade of larger economies's can be explained by the fact that they trade a larger set of goods (rather than larger quantities of a common set of goods). This evidence is consistent with the notion that richer countries have a comparative advantage in differentiated goods.

since for many countries unit values are available only at a very aggregated level researchers resort to employing unit values of US imports from various countries implicitly assuming that a particular country sells goods of the same quality to each of its export markets. Information on trademark registrations does not suffer from these drawbacks. In particular, on account of its wide coverage in terms of countries and time, we do not need to rely on quality proxies derived from the data for a particular importer.

Our analysis proceeds in several stages. We first review the basic economics of the trademark system (Section II). Based on a newly constructed database of international trademark registrations, we then examine the determinants of bilateral trademark registrations in 22 sectors in 100 countries during the period 1994-1998 (Section III). We find that a country is more likely to register its trademarks in less distant economies and in countries where the same language is spoken. Moreover, the strength of trademark protection in destination countries (where a mark is being filed) is positively correlated with the number of foreign trademarks registered. The number of newly registered trademarks in a particular sector also depends on the worldwide volume of exports from the source country in the particular industry as well as the worldwide volume of imports in the destination country in this sector.

Next we develop a conceptual model that introduces the expanded 'Linder effect' in a gravity type estimation framework (Section IV). This model is then estimated using two proxies constructed from our trademark database (Section V). First, we employ the share of an exporting country's registrations in nonresident trademark registrations in a destination economy in a given sector. We find support for income-related trade flow biases in 10 out of 22 regressions estimated at the sectoral level. These biases can mainly be found in consumer goods industries, such as, food products, beverages, tobacco, wearing apparel and footwear, leather products and furniture. No biases are detected in intermediate input sectors, including petroleum and coal products, industrial chemicals, other chemicals, iron and steel, rubber products, and non-metallic products.

Our second proxy for export quality and horizontal product differentiation is the residual from a first stage regression of factors driving trademark registrations, including variables intended to capture demand for trademarks in a particular destination country. Using this measure, we find support for the Linder hypothesis in 14 of 22 sectoral estimations. Again the biases are present in consumer goods industries, such as, food products, beverages, wearing apparel and footwear and textiles. They are also detected in the most trademark-intensive sectors, including other chemicals, professional and scientific equipment; paper, printing and publishing.

As we conclude in the final section of the paper (Section VI), the evidence of income-related trade biases suggests that developing countries, which are less likely to produce high quality or horizontally differentiated products, may be at a disadvantage in selling their goods to the rich world. This implies that reductions of trade barriers on manufactured goods in the developing—rather than the developed—world will have a stronger impact on developing country exports.

II. The economics of the trademark system

Trademarks are words, signs, symbols or combinations thereof that identify goods as manufactured by a particular person or a company, therefore allowing consumers to distinguish between goods originating in different sources. In order to receive legal protection against unauthorized use by third parties, businesses and individuals file trademarks in official registrars. Such registrations are valid for a limited time period, typically ten years. However, prior to expiration, trademark holders have the option of renewing their registrations. Through continuing renewals, and absent any act or failure to act which might call the rights concerned into question, trademark registrations can virtually last forever.[3]

In practice, the number of trademarks sought out for a one product can vary substantially across producers. For example, the brand of the Korean car manufacturer "Hyundai" is protected by 25 trademarks in the United States, whereas the Mercedes brand has 57 trademarks registered in the United States.[4] Typically, there are a number

[3] A special case is when trademarks become part of the public domain. For example, the "Xerox" or "Walkman" trademarks were judged to have become part of the common vocabulary and the trademark holders were asked by certain jurisdictions—against a financial compensation—to give up their exclusive rights.

[4] These trademark counts are counts of 'live' trademarks from the TESS database available at www.uspto.gov, as of August 2003.

of ways in which imitators can take advantage of consumers' knowledge of a particular brand—ranging from the name of the brand to its logo, the design and other product-specific features.[5] Obtaining a large number of trademarks serves as a more effective protection against product imitation.

To better understand firms' incentives to register trademarks in foreign nations, it is helpful to briefly review the relevant economic literature. The fundamental economic rationale of trademark protection goes back to Akerlof's (1970) seminal insight regarding the failure of markets to provide for an efficient allocation of resources if consumers are unable to assess the quality of products offered to them. In this situation, information asymmetries between sellers and buyers prevent some transactions in high quality goods from occurring, thus leading to inefficiencies. Trademarks offer a way around this dilemma. As producers of goods develop a reputation for quality over time, consumers can use brand names to distinguish between a premium quality product and a low-end product.[6]

A trademark registration itself, however, says little about the level of quality of the underlying product. Yet, there are a number of reasons why we would expect high quality producers to seek out more trademarks. First, it is important to note that trademarks are not costless, especially when protection is sought in a large number of jurisdictions. Besides the registration fee, firms have to incur expenses for legal services and possibly translation of the trademark application into a foreign language as well as bear the costs of monitoring for potential infringement. Thus, a producer will only file an application if the expected benefits from protection exceed its costs.

A variety of arguments can be invoked as to why the expected benefits from protection are likely to be larger for high quality producers. A key benefit of protection is, of course, the reduced likelihood of brand imitation. This likelihood is usually greater for high quality products, as the price premium relative to low quality products—and thus the pay-off from imitation—is larger. Moreover, as originally noted by Nelson (1970),

[5] In an econometric investigation on the optimal number of trademarks registered per firm in the United States, Sullivan (2001) finds that this number is related to the number and diversity of products, consumer knowledge of a firm's product(s), and overall demand for the brand.

[6] Shapiro (1982) has shown that reputation mechanism can work only imperfectly, because high quality producers are rewarded only with a lag.

sellers of high-quality products have a greater incentive to spend money on advertising to persuade consumers to try their goods, because the present value of a trial purchase is larger than in the case of low-quality producers.[7] This also means that for a rational consumer, the fact that a firm spends money on advertisements provides in itself information on product quality—regardless of the advertising content.[8] Hence, consumers may have greater knowledge about advertised high quality products, once again increasing the pay-offs from and the likelihood of imitation. Finally, the trademark registration itself may send a signal on quality, as consumers know that high quality producers face a greater risk of brand imitation. Indeed, high quality manufacturers often convey explicitly that their brands are protected by trademarks (using symbols such as "®" or "TM").

The rationale of trademark protection goes beyond pure quality considerations, however. Unless goods take the form of purely homogenous commodities, firms tend to differentiate their products *horizontally*. For example, producers attach features to a product not necessarily linked to quality, such as the shape or color of goods. For some categories of goods, the mere use or display of a particular branded product confers prestige on their owners. Product differentiation strategies are often critical for maintaining competitiveness and firms often spend substantial resources on marketing their goods to consumers. By identifying the original producer of a product, trademarks can be seen as a prerequisite for firms to recoup these investments in marketing. If other firms could free ride on the original producers' marketing efforts, no producer would have an incentive to invest in the marketing of goods and services.

[7] Note, however, that Schmalensee (1978) who analyzes the relationship between advertising and product quality more formally, shows that under certain assumptions and parameter values, it is possible that the lowest-quality brands have the largest advertising budgets, market shares, and profits. This is especially likely if buyers' behavior indicates confidence that better brands spend more on advertising. He concludes that "… while many of the natural generalizations of this model seem likely to reduce the incidence of negative advertising/quality correlations, I conjecture that most will not suffice to rule them out."

[8] Klein and Leffler (1981) make a related argument. They develop a model whereby consumers do not buy high quality products below a certain premium price that indeed gives firms an incentive to produce at high quality instead of cashing in on a short-term cheat. If market entry is free, firms engage in non-price competition, involving sunk investments in the design of a firm logo and advertising. These investments send a signal about high quality to consumers, as their non-salvageable character acts as a 'collateral' that a firm has indeed chosen the high quality business plan.

As above, the greater the importance of product differentiation strategies for a particular company, the greater is the risk of brand imitation and the greater are the benefits from the protection afforded by the trademark system. All else equal, we would expect to see more trademark registrations in sectors in which product differentiation plays a more important role. In addition, high quality producers typically rely to a greater extent on horizontal product differentiation than low quality producers, reinforcing their interest in protection against brand imitation.[9] All of the above mentioned characteristics make trademark registrations a suitable proxy for product quality and horizontal product differentiation.

III. Determinants of international trademark registrations

Before examining how quality and product differentiation affect trade patterns, it is helpful to investigate what motivates firms to register trademarks internationally. In this section, we present the results of an exploratory regressions on the determinants of international trademark registrations. Specifically, we estimate the following equation:

$$\begin{aligned} lnR_{ijkt} &= \alpha + \beta_1 TMProtection_j + \beta_2 lnX_{ikt} + \beta_3 lnM_{jkt} + \beta_4 lnDistance_{ij} \\ &+ \beta_5 lnGDPpc_{jt} + \beta_6 lnGDPpc_{it} + \beta_7 Language_{ij} + \beta_8 Madrid_{ijt} + \beta_9 Renewal_j \\ &+ \beta_{10} FormerUSSR_j + \delta_t + \varepsilon_{ijkt} \end{aligned}$$

where subscripts *i*, *j*, *k* and t stand for source and destination countries, sector and year, respectively. R_{ijkt} is the number of new trademarks registered by country *i* in country *j* in sector *k* at time *t*. The figures on trademark registrations come from a database created by Baroncelli, Fink and Javorcik (2002) based on the data published by the World Intellectual Property Organization (WIPO). After adding data on trade and deleting the missing observations we obtained a database that contains information on bilateral trade flows and trademark registrations spanning from 1994 to 1998 and covering 22 source

[9] In addition to providing incentives to invest in quality and marketing, the trademark system is also sometimes credited for encouraging product innovations by allowing firms to appropriate associated rents. For example, in a case study of the Benelux countries, Allegrezza and Guard-Rauchs (1999) find that firms registering trademarks tend to incur high research and development (R&D) expenditure. Since one would expect a positive relationship between high quality production and R&D intensity, this finding can be viewed as consistent with the notion that high quality producers seek out more trademarks.

countries, 100 destination countries in 22 three-digits ISIC manufacturing sectors. The Data Appendix provides a list of all the source and destination countries and describes the concordance employed in matching sectors classified according to the Nice Trademark Classification System to the ISIC system (see Table 1).

As explanatory variables, we incorporate the strength of the trademark protection regime in the destination country ($TMProtection_j$), as measured by the trademark protection index recently compiled by Reynolds (forthcoming). This index is based on a detail analysis of national trademark regimes with regard to five broad criteria: the types of marks allowed, coverage, limitations to trademark ownership, procedural hurdles, and membership in international trademark-related treaties. An index value is the simple average of the scores a country receives in these five categories. Higher values of the index correspond to stronger trademark regimes, and thus we would expect to find a positive coefficient on this variable. Next, we include the value of sector *k*'s exports from source country *i* to the world (X_{ikt}) and the value of sector *k*'s imports of destination country from the world (M_{jkt}). We expect that large exporters of sector *k* products are likely to have a larger number of domestic trademarks in the industry, while large importers are more attractive destinations for trademark registrations. The data on exports and imports come from the UN COMTRADE database. We also control for per capita GDPs of source and destination country, expecting that richer countries are more likely to develop more trademarks, while better off destination are more likely to demand more high quality goods. The per capita GDP figures come from the World Bank's World Development Indicators.

Further, we employ the well-known bilateral trade cost proxies, reasoning that closer commercial ties between nations will lead to more trademark registrations. These proxies are the distance between the pair of countries and a dummy for common language. The distance measure refers to the straight-line distance between nations' capitals and was taken from the City Distance Calculator provided by VulcanSoft.[10] In addition, we construct a dummy variable that is one if the two countries are both

[10] The software can be freely downloaded at www.vulcansoft.com.

members of the Madrid system—the international trademark registration system administered by WIPO that facilitates the filing of one trademark in multiple countries.[11]

Finally, since the trademark registration data for some countries include the sum of both new registrations and trademark renewals, which, unfortunately cannot be separated into subtotals, we include an additional dummy ($Renewal_j$) in the regression to take this fact into account. Further, since many successor states of the Soviet Union required re-registration of trademarks existing previously in the USSR, we add a dummy for these countries. The summary statistics for all the variables used in the estimation are presented in Table 2.

Table 3 presents the results from the estimation of the above equation for each of the 22 three-digit manufacturing industries. Each regression contains year dummies. The standard errors have been corrected for heteroskedasticity using the White method. We find that the number of newly registered trademarks depends on the worldwide volume of exports from the source country in a particular industry, which seems intuitive as a larger export sector is likely to consist of more firms and cover a wider range of products. Similarly, the higher the GDP per capita of the source country the larger the number of registrations, which is consistent with the notion that more developed economies have a comparative advantage in the production of high quality and differentiated goods.[12]

Further, we find a positive impact of the worldwide volume of imports in the destination country in the same sector, which suggests that larger import markets attract more trademark registrations. The results also indicate that registrations are more likely to take place in less distant economies, in countries where the same language is spoken and among countries that participate in the Madrid registration system. The dummy variable for renewals and USSR successor states is mostly positive and significant, as expected. The trademark protection index exhibits a mixed performance, with both positive and negative coefficients. This may be explained by the possibility that the strength of trademark protection depends to a large extent on law enforcement, which may be inadequately captured by the index developed by Reynolds.

[11] See Baroncelli, Fink and Javorcik (2002) for a brief description of the Madrid registration system.

[12] This result is also consistent with Hummels and Klenow (2002), who find that, adjusted for the size of a country's labor force, richer economies tend to trade a wider range of products.

Contrary to our expectations, however, we find that the per capita GDP of a destination country is in most cases negatively correlated with the number of trademark registrations. There are two possible explanations for this result. First, given the low cost of registering trademarks relative to other fixed costs of entering foreign markets, firms may just seek out trademarks in every jurisdiction in which they have a commercial interest—although this possibility could only explain a non-significant coefficient. Second, it could be that trademark registrations during the 1994-1998 period were particularly high in a number of emerging markets represented in our sample. While per capita income in these fast-growing markets is still relatively low, they may experience a greater inflow of trademarks, as future business prospects in these markets are especially attractive.

IV. Testing for income-related biases in trade: an empirical model

In this section, we develop a simple model of bilateral trade that accounts for the 'expanded' Linder hypothesis and that results in the well-known gravity type estimation equation. Following Deardorff (1998), let consumer preference be portrayed by a utility function that is Cobb-Douglas over sectors and CES within sectors:

$$U^j = \prod_k \left[\left(\sum_i a_{ijk}\, c_{ijk}^{(\sigma_k - 1)/\sigma_k} \right)^{\sigma_k/(\sigma_k - 1)} \right]^{\rho_{jk}}, \qquad (1)$$

$$a_{ijk} = f(\beta_j, \theta_{ik}), \qquad \beta_j, \theta_{ik} > 0,\ f_{\beta_j} > 0,\ f_{\theta_{ik}} > 0 \qquad (2)$$

where c_{ijk} is country *j*'s consumption of sector *k*'s good produced by country *i*, σ_k the elasticity of substitution between any pair of countries' products in sector *k*, ρ_{jk} is country *j*'s (constant) share of expenditure devoted to sector *k*, and a_{ijk} is a CES preference parameter. This latter parameter is a function of the degree of product differentiation (vertical and horizontal) of country *i*'s good in sector *k*, θ_{ik}, and *j*'s preference for quality and exclusiveness, β_j—both of which are assumed to be exogenously given. Note that unless β_j is the same across all countries and price differences exactly compensate for differences in θ_{ik}, quantity cannot perfectly substitute for quality. The term a_{ijk} thus captures the expanded 'Linder effect.'

Consumers in *j* derive their income, Y_j, from producing domestic products x_{jk} at prices p_{jk}. They face trade cost inclusive prices of consumption goods $t_{ijk}\, p_{ik}$, where the trade cost factor t_{ijk} is assumed to be equal to one for the domestically produced good and greater than one for foreign produced goods. Constrained maximization of (1) leads to optimal consumption levels

$$c_{ijk} = \frac{1}{t_{ijk}\, p_{ik}} \rho_{jk} Y_j a_{ijk}^{\sigma_k} \left(\frac{t_{ijk}\, p_{ik}}{p_{jk}^{I}} \right)^{1-\sigma_k}, \tag{3}$$

where p_{jk}^{I} is an index of trade cost inclusive prices

$$p_{jk}^{I} = \left(\sum_i \beta_{ijk}^{\sigma_k} t_{ijk}^{1-\sigma_k}\, p_{ik}^{1-\sigma_k} \right)^{1/(1-\sigma_k)}. \tag{4}$$

Multiplying (3) by the trade cost inclusive price $t_{ijk}\, p_{ik}$ yields the value of exports from country *i* to *j* in sector *k*, T_{ij}^{k}:

$$T_{ij}^{k} = \rho_{jk} Y_j a_{ijk}^{\sigma_k} \left(\frac{t_{ijk}\, p_{ik}}{p_{jk}^{I}} \right)^{1-\sigma_k}. \tag{5}$$

The variables on the right hand side are a mix of exogenous and endogenous variables. To fully estimate the model, one would need to specify supply conditions. However, since we are primarily interested in the 'Linder effect' that is identified by bilateral variation in trade flows, we can proceed by employing importer and exporter specific dummy variables to control for the country specific exogenous and endogenous variables.[13] The advantage of this approach is that our empirical model embeds

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[13] This approach is consistent with recent empirical applications of the gravity equation, including Hummels (1999), Hallack (2001), Redding and Venables (2001), and Fink et al. (2002). Note that the

alternative supply determinants of trade.[14] The resulting gravity type equation for bilateral trade between *i* and *j* in sector *k* can be expressed as:

$$\ln T_{ij}^{k} = E_{i}^{k} + I_{j}^{k} + (1-\sigma_{k})\ln t_{ijk} + \sigma_{k}\ln a_{ijk} + \varepsilon_{ij}^{k}, \qquad (6)$$

where E_i^k is a set of exporter fixed effects, I_j^k is set of importer fixed effects, and ε_{ij}^k is a normally distributed error term. A useful feature of our estimation equation (6) is that the inclusion of exporter and importer fixed effects can correct for the omission of variables that are country specific (e.g., non-tariff barriers, differences in inland transportation costs, availability of export finance).

We will capture the trade cost factor t_{ijk} by bilateral distance and dummy variables for sharing a common language and joint participation in preferential trade agreements (PTAs). The Linder term a_{ijk} will be captured by the product of the importing country's per capita income and a measure of the exporting country's extent of product differentiation, as captured by our trademark registration data. Since all these variables do not directly measure t_{ijk} and a_{ijk}, the estimated coefficients will not represent estimates of the elasticity of substitution σ_k, but will also reflect the elasticities in the trade cost function and the Linder preference function, respectively.

V. Estimation Results

In this section, we use our database on international trademark registrations to test the expanded Linder hypothesis in the estimation framework developed above. There are several advantages to employing trademarks for this purpose. First, information on trademark registrations has a wide coverage in terms of countries (and time), and thus in contrast to the earlier work by Hallak (2001) we do not need to rely on quality proxies

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inclusion of importer and exporter fixed effects captures the multilateral resistance terms identified by Anderson and van Wincoop (2003).

[14] Indeed, the gravity equation has been shown to be consistent with a variety of trade models, including the simple Ricardian and Heckscher-Ohlin theories as well as newer theories with increasing returns to scale and monopolistic competition. See, for example, Anderson (1997), Helpman and Krugman (1985), Bergstrand (1985 and 1989) and Deardorff (1998).

derived from the data for one particular importer. Second, we do not employ unit value figures which, even at a very disaggregated level, can be problematic, as they may be capturing different products rather than different quality levels of the same good and may also reflect vertical pricing considerations in imperfectly competitive markets.[15]

One drawback of our database is that we only have information on the *flow* of new trademark registrations and not on the *stock* of existing registrations. Surely, one would expect past trademark filings to have an effect on current trade patterns, especially in sectors with long product cycles. At the same time, using the limited data that exist on trademark stocks, we find a strong positive correlation between stocks and flows as well as a strong positive correlation of bilateral trademark registrations over time.[16] Since most of the variation in our data is cross-section, the bias from using flow data is likely to be small.[17]

Using the trademark registration data, we construct two measures of quality and product differentiation of exports—each with its own advantages and disadvantages. First, we calculate the share of country i's trademarks registered in country j in sector k at time t in all non-resident trademarks registered in country j in sector k at time t. As explained in the previous section and reflected in equation (6), this variable enters the regression equation interactively with per capita GDP. A positive and statistically significant coefficient on this interactive term would lend support to the Linder hypothesis.

Note that the inclusion of exporter fixed effects explicitly controls for the overall size of a country's exports. Thus, while larger exporters are likely to exhibit greater

[15] For example, see Maskus and Chen (2002) for a model of vertical pricing of a monopoly manufacturer who sells goods in a foreign market through an independent distributor.

[16] WIPO publishes data on countries' total stock of trademarks in a given year (but not broken down by origin of the trademark holder or by industry). The bivariate correlation between this aggregate stock figure and the total number of registration in the same year is 0.86.

[17] Another potential criticism of the use of trademark data is that cross-country differences in the number of registered trademarks may reflect differences in firms' sophistication in using the trademark system. It is not clear, however, whether developing countries are less sophisticated in this regard. For example, Baroncelli, Fink and Javorcik (2002) show that middle income countries are heavy users of the trademark system, as reflected, for example, in the fact that the majority share of national registrations are from domestic residents. For anecdotal evidence on how Chinese consumer-goods makers are starting to pay attention to brand building see The Economist (*"Just do it" Chinese-style*, August 2, 2003). In any case, cross-country differences in country's sophistication in using trademarks are absorbed by the exporter fixed effects included in our regressions.

trademark shares in the importing country, our regression approach tests the Linder hypothesis by relying only on the bilateral variation in the data within the same exporting country.

The estimation results are presented in Table 4. We find support for the Linder hypothesis in 10 out of 22 sectoral estimations. Consistent with our intuition, the Linder hypothesis holds mainly in consumer goods industries, such as food products, beverages, tobacco, wearing apparel and footwear, leather products and furniture. All of these sectors are intensive users of the trademark system—as measured by Baroncelli et al. (2001). The hypothesis finds no confirmation in intermediate input sectors, such as petroleum and coal products, industrial chemicals, other chemicals, iron and steel, rubber products, non-metallic products. As for the other variables, we find a negative and significant coefficient on distance and a positive and significant coefficient on the language dummy. The impact of PTA participation, however, shows a mixed performance, which is in line with the previous gravity literature.[18]

The above approach has, however, one drawback. It takes trademark registration shares as given and uses them as proxies for vertical and horizontal product differentiation, without controlling for other bilateral factors driving a decision to register a trademark, such as, distance or linguistic differences. Therefore, in our second approach we explicitly control for determinants of trademark registrations other than product differentiation. We employ the residuals of a first stage regression similar to the one presented in Section III. One can think of a simple model whereby the supply of trademarks is perfectly inelastic (assuming trademark offices function smoothly) and the equilibrium number of trademarks is determined solely by the demand for registrations. Controlling for the size of the source country's exports, importer specific effects, as well as the standard set of 'bilateral ties,' the difference between actual and predicted trademark registrations should reflect the average degree of product differentiation of goods traded between two countries.

Specifically, we estimate the following first stage regression equation:

[18] See, for example, Soloaga and Winters (1999) and Smarzynska (2001).

$$
\begin{aligned}
lnR_{ijkt} &= I_j + \delta_1 lnX_{ikt} + \delta_2 lnM_{jkt} + \delta_3 lnDistance_{ij} \\
&+ \delta_4 lnGDPpc_{jt} + \delta_5 Language_{ij} + \delta_6 Madrid_{ijt} + \delta_7 PTA_{ijt} + \delta_8 Renewal_j \\
&+ \delta_9 FormerUSSR_j + \gamma_t + \varepsilon_{ijkt}
\end{aligned}
$$

In contrast to the exploratory regression in Section III, we include a set of importer fixed effects in this regression. Since we are interested in obtaining a measure of product differentiation of goods supplied from country *i* to country *j* in industry *k*, these fixed effects allow us to control for (time invariant) determinants of demand for differentiated products in the destination country. Since we are using importer fixed effects, we need to exclude the trademark protection index of the destination country which is a time-invariant variable. Moreover, total sectoral imports and per capita GDP of the destination country *j* now only contribute to the explanation of variations in trademark flows over time. Note that, unlike before, we do not include per capita GDP of the source country, as this would partly take away what we intend to measure with the residuals.

The estimation results from the above equation estimated for each sector separately (not presented here) are very similar to those obtained in Section III. We proceed by calculating the residuals from these estimations and employing them (interacted with per capita GDP of the destination countries) in the familiar gravity regression on bilateral trade specified in equation (6).

As the figures in Table 5 indicate, the interaction between the proxy for product differentiation of exports (obtained in the first stage regression) and the importer's GDP per capita lends support to the Linder hypothesis, bearing a positive and statistically significant coefficient in 14 of 22 sectoral estimations. While the presence of the effect in consumer goods industries is less discernible than before, the Linder hypothesis still holds in key consumer goods sectors such as wearing apparel and footwear, food products, beverages and textiles. Moreover, the effect is also detected in the most trademark-intensive sectors (as identified in Baroncelli et al., 2001), including other chemicals, professional and scientific equipment; paper, printing and publishing.

As for the other variables, distance takes on the usual significantly negative sign, language is mostly positive and significant, and the preferential trading dummy shows a positive and significant coefficient in about half of the sectors, with only one coefficient being negative and significant.

To summarize, we conclude that higher quality and horizontal product differentiation positively affects exports to rich country markets. While each of the two proxies used has its own advantages and drawbacks and produces somewhat different results across sectors, one conclusion emerges from both approaches: quality and product differentiation matters more for consumer and trademark-intensive goods.

VI. Conclusions

This study has employed a novel approach, based on information on international trademark registrations, to test an expanded Linder hypothesis stating that richer countries tend to import higher quality and more differentiated goods. The use of trademark data overcomes many of the drawbacks of the earlier literature relying on unit values of imports as a measure of import quality. The study first explores international determinants of trademark registrations and then uses trademark registration data to derive two proxies for the extent of quality and horizontal product differentiation of traded goods. The two proxies are subsequently interacted with per capita GDP of the importing country and incorporated into a gravity equation estimated at the industry level. We find the Linder effect to be more pronounced in consumer goods and trademark-intensive sectors, but small or non-existent for a number of intermediate goods sector.

The evidence in support of the expanded Linder effect may have some important policy implications. It suggests that developing countries' market access interests in the developed world may differ significantly from their market access interests in the developing world. Further, it suggests that developing countries may be at a disadvantage in selling manufactured products to the rich world (see also Murphy and Shleifer, 1997), which may limit the benefits brought by the reduction of trade barriers in industrialized countries.

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Data Appendix

Destination Countries: Albania, Algeria, Andorra, Armenia, Australia, Austria, Azerbaijan, Belarus, Benelux, Bolivia, Bosnia & Herzegovina, Brazil, Brunei Darussalam, Bulgaria, Chile, China, Colombia, Croatia, Cuba, Czech Republic, Dem. People's Republic of Korea, Denmark, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Georgia, Ghana, Guatemala, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Ireland, Italy, Jamaica, Japan, Kazakhstan, Kenya, Kyrgyzstan, Laos, Latvia, Lesotho, Liberia, Liechtenstein, Lithuania, Macau, Malawi, Malta, Mauritius, Mexico, Monaco, Mongolia, Morocco, Mozambique, Netherlands Antilles, New Zealand, Nicaragua, Norway, Oman, Pakistan, Panama, Peru, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, San Marino, Sierra Leone, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, T F Y R Macedonia, Tajikistan, Thailand, Trinidad & Tobago, Tunisia, Turkey, Ukraine, United Kingdom, Uruguay, Uzbekistan, Venezuela, Viet Nam, Yugoslavia, Zambia, Zimbabwe

Source Countries: Australia, Austria, Belgium, Canada, China, Denmark, Finland, France, Germany, Hungary, Italy, Japan, Netherlands, Norway, Portugal, Republic of Korea, Russian Federation, Spain, Sweden, Switzerland, United Kingdom, United States of America

Table 1. Concordance between Nice Classification and ISIC Classification

NICE classification	ISIC	ISIC classification
1	351	Industrial chemicals
2,3,5	352	Other chemicals
4	354	Miscellaneous petroleum and coal products
6	371	Iron and Steel
7	382	Machinery, except electrical
8	381	Fabricated metal products
9,10	385	Professional and scientific equipment
11	383	Machinery, electric
12	384	Transport equipment
13,15,28	390	Other manufactured products
14	372	Non-ferrous metals
16	341, 342, 356	Paper and products & Printing and publishing &Plastic products
17	355	Rubber products
18	323	Leather products
19	369	Other non-metallic mineral products
20	332	Furniture, except metal
21	361, 362	Pottery, china, earthenware & Glass and products
22,23,24,26,27	321	Textiles
25	322, 324	Wearing apparel, except footwear & Footwear, except rubber or plastic
29,30,31	311	Food products
32,33	313	Beverages
34	314	Tobacco

Source: Developed by authors based on detailed descriptions of product and industry categories.

Table 2. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Trademarks Registrations	173,574*	14.16	88.60	0.00	14193.00
Trade	102,066	67660.14	394175.30	0.00	22900000.00
Imports from the world	114,708	1503654.00	4125001.00	54.09	53700000.00
Exports to the world	162,659	6481474.00	14600000.00	240.39	125000000.00
GDP per capita destination country	156,574	7213.55	9889.46	139.19	41840.40
GDP per capita source country	173,580	21663.48	10619.65	455.21	43639.11
Trademark Registrations$_{ijkt}$/Trademark registrations$_{jkt}$	161,364	0.05	0.10	0.00	1.00
Trade index Destination	132,990	0.46	0.15	0.00	0.77
Distance	158,224	6093.10	4415.05	0.00	19845.00
Madrid Membership	173,580	0.22	0.41	0	1
Renewal	173,580	0.10	0.30	0	1
Renewal USSR	173,580	0.04	0.19	0	1

* Of which 79072 are non-zero.

Table 3. Explorative Regression on the Determinants of International Trademark Registrations

	Other chemicals	Professional and scientific equip	Paper and Printing	Wearing apparel	Food Products	Beverages	Tobacco	Textiles	Leather	Furniture	Rubber products
ln Imports from the World	0.2875***	0.3191***	0.2350***	0.2889***	0.2459***	0.1853***	0.0581***	0.1890***	0.2126***	0.2655***	0.2171***
	(0.0191)	(0.0149)	(0.0227)	(0.0193)	(0.0202)	(0.0215)	(0.0160)	(0.0187)	(0.0153)	(0.0257)	(0.0226)
ln Exports to the World	0.9586***	0.8855***	0.5916***	0.6705***	0.5602***	0.3846***	0.2304***	0.7323***	0.5774***	0.4262***	0.4962***
	(0.0158)	(0.0154)	(0.0296)	(0.0174)	(0.0202)	(0.0177)	(0.0142)	(0.0225)	(0.0208)	(0.0232)	(0.0200)
ln Distance	-0.4068***	-0.4547***	-0.3707***	-0.3298***	-0.5165***	-0.3960***	-0.3570***	-0.5568***	-0.4172***	-0.3875***	-0.4938***
	(0.0213)	(0.0214)	(0.0255)	(0.0230)	(0.0245)	(0.0248)	(0.0260)	(0.0257)	(0.0240)	(0.0257)	(0.0269)
Madrid Member	0.2584***	0.2449***	0.3280***	0.3506***	0.3028***	0.2999***	0.1997***	0.3360***	0.2177***	0.2998***	0.4076***
	(0.0498)	(0.0517)	(0.0665)	(0.0579)	(0.0585)	(0.0628)	(0.0619)	(0.0632)	(0.0605)	(0.0684)	(0.0597)
Language	0.6283***	0.8376***	0.8483***	0.8903***	0.5784***	0.5965***	0.1898**	0.5816***	0.5236***	0.6031***	0.4311***
	(0.0756)	(0.0808)	(0.1025)	(0.0853)	(0.0871)	(0.0924)	(0.0908)	(0.0978)	(0.0890)	(0.1001)	(0.1029)
TM Protection	-0.3125**	0.5720***	0.2247	0.0713	0.2227	0.3036	-0.0117	-0.1809	0.4953***	0.0819	-0.3047*
	(0.1416)	(0.1441)	(0.1985)	(0.1670)	(0.1905)	(0.1859)	(0.1779)	(0.1870)	(0.1723)	(0.1871)	(0.1837)
Renewal	-0.2066***	-0.1194*	-0.1438	-0.0600	-0.2870***	0.0288	0.0798	0.1066	-0.1000	0.0474	-0.1452
	(0.0763)	(0.0707)	(0.0947)	(0.0827)	(0.0922)	(0.0950)	(0.0877)	(0.0875)	(0.0965)	(0.0919)	(0.0917)
Former USSR	0.6177**	0.6443***	0.7352***	0.7475***	0.2890	0.1220	0.4174*	1.0666***	0.7764***	0.2716	0.3071
	(0.2818)	(0.2315)	(0.2771)	(0.1917)	(0.2719)	(0.2512)	(0.2163)	(0.2611)	(0.2421)	(0.2793)	(0.2273)
lnGDPpc Destination	-0.1723***	-0.1496***	-0.1666***	-0.2237***	-0.1358***	-0.1773***	-0.1777***	-0.1824***	-0.1508***	-0.3216***	-0.1921***
	(0.0207)	(0.0216)	(0.0272)	(0.0301)	(0.0226)	(0.0290)	(0.0240)	(0.0237)	(0.0235)	(0.0364)	(0.0261)
lnGDPpc Source	0.0254	0.1957***	0.3727***	0.7786***	0.3691***	0.1999***	0.1619***	0.3632***	0.6526***	0.3015***	0.6315***
	(0.0253)	(0.0198)	(0.0293)	(0.0265)	(0.0235)	(0.0273)	(0.0234)	(0.0277)	(0.0329)	(0.0308)	(0.0425)
Constant	-10.5793***	-11.9195***	-9.2116***	-14.4350***	-7.7428***	-2.8346***	0.8491**	-9.1620***	-10.5998***	-4.7472***	-8.6728***
	(0.4442)	(0.3813)	(0.5935)	(0.5604)	(0.5099)	(0.4928)		(0.5955)	(0.5949)	(0.5870)	(0.5635)
Year Dummies	Yes	Yes	Yes	Yes	Yes	yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	3013	2880	2455	2610	2724	2538	1824	2140	2048	1931	1874
F stat	371.98	359.77	110.49	180.74	148.48	81.15	50.73	110.64	115.75	64.78	84.3
Prob >F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.62	0.62	0.34	0.47	0.40	0.29	0.26	0.42	0.45	0.33	0.40

Table 3 continued

	Pottery, china	Non metalic mineral products	Iron and steel	Non-ferrous metals	Fabricated metal prod.	Machinery, except electrical	Machinery electrical	Transport equipm.	Other manufactured goods	Industrial Chemicals	Petroleum and Coal
ln Imports from the World	0.1824***	0.2533***	0.2207***	0.1975***	0.1505***	0.2948***	0.2022***	0.1738***	0.2002***	0.2555***	0.1096***
	(0.0250)	(0.0228)	(0.0204)	(0.0198)	(0.0236)	(0.0172)	(0.0177)	(0.0208)	(0.0178)	(0.0177)	(0.0186)
ln Exports from the World	0.4403***	0.5187***	0.5709***	0.4658***	0.8294***	0.7308***	0.6047***	0.5651***	0.5765***	0.7602***	0.3717***
	(0.0204)	(0.0207)	(0.0265)	(0.0321)	(0.0281)	(0.0185)	(0.0205)	(0.0200)	(0.0189)	(0.0185)	(0.0160)
ln Distance	-0.4298***	-0.4627***	-0.4477***	-0.4027***	-0.4054***	-0.4396***	-0.5166***	-0.3047***	-0.4373***	-0.4680***	-0.3770***
	(0.0262)	(0.0234)	(0.0244)	(0.0299)	(0.0250)	(0.0224)	(0.0252)	(0.0237)	(0.0244)	(0.0237)	(0.0242)
Madrid	0.2287***	0.3821***	0.4053***	0.2028***	0.3833***	0.3429***	0.3663***	0.2147***	0.2600***	0.3686***	0.3418***
	(0.0667)	(0.0582)	(0.0617)	(0.0743)	(0.0649)	(0.0559)	(0.0616)	(0.0624)	(0.0616)	(0.0519)	(0.0583)
Language	0.5978***	0.6766***	0.5932***	0.0080	0.4612***	0.3832***	0.6702***	0.1908**	0.7546***	0.4177***	0.4206***
	(0.0989)	(0.0827)	(0.0931)	(0.1096)	(0.0920)	(0.0834)	(0.0824)	(0.0902)	(0.0983)	(0.0820)	(0.0895)
TM Protection	0.1686	0.0010	-0.0216	-0.0407	-0.0348	0.1293	0.2568	0.6207***	0.6412***	-0.0471	-0.4727**
	(0.1884)	(0.1663)	(0.1870)	(0.2074)	(0.1827)	(0.1558)	(0.1701)	(0.1648)	(0.1827)	(0.1662)	(0.1860)
Renewal	-0.1966**	-0.1020	-0.0289	-0.0134	0.0448	0.1529**	-0.0674	-0.1584*	0.0760	0.0658	0.1223
	(0.1004)	(0.0846)	(0.0869)	(0.0998)	(0.0817)	(0.0683)	(0.0846)	(0.0941)	(0.0848)	(0.0759)	(0.0867)
Former USSR	0.4862**	0.4326**	0.5176**	0.5474*	0.1773	0.5498***	0.6131**	0.3113	0.7935***	0.7948***	0.2519
	(0.2263)	(0.2182)	(0.2476)	(0.2935)	(0.2037)	(0.1903)	(0.2435)	(0.2720)	(0.2951)	(0.2129)	(0.2080)
ln GDPpc Destination	-0.1991***	-0.1764***	-0.1470***	-0.2361***	-0.1858***	-0.1655***	-0.1676***	-0.1188***	-0.2132***	-0.1340***	-0.1781***
	(0.0336)	(0.0245)	(0.0241)	(0.0307)	(0.0283)	(0.0220)	(0.0254)	(0.0269)	(0.0278)	(0.0216)	(0.0221)
ln GDPpc Source	0.4134***	0.4402***	0.3220***	0.4795***	0.2423***	0.0829***	0.1645***	0.0705***	0.3733***	0.4020***	0.3874***
	(0.0282)	(0.0265)	(0.0249)	(0.0310)	(0.0298)	(0.0232)	(0.0252)	(0.0262)	(0.0260)		(0.0262)
Constant	-4.8688***	-7.9487***	-8.3097***	-7.2945***	-11.0059***	-10.7036***	-7.2971***	-7.5859***	-8.0385***	-12.6702***	-3.3352***
	(0.5523)	(0.5136)	(0.5941)	(0.6573)	(0.5416)	(0.4648)	(0.5191)	(0.4497)	(0.5121)	(0.4432)	(0.4409)
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes	yes
Number of obs.	1981	1961	2071	1889	1645	2394	2292	2214	2257	2377	1671
F stat	73.25	100.4	90.17	64.56	108.88	165.17	103.79	100.58	101.4	193.49	80.63
Prob >F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.32	0.41	0.35	0.3	0.44	0.49	0.38	0.35	0.41	0.52	0.34

Robust standard errors are presented in parentheses. ***, **, * denote significance at 1, 5 and 10 percent level, respectively.

Table 4. Gravity Estimations Using Trademark Shares as Measure of Exporter Quality

	Other chemicals	Professional and scientific equipment	Paper, printing, publishing	Wearing apparel footwear	Food Products	Beverages	Tobacco	Textiles	Leather Products	Furniture
Linder term	0.0043	0.0102	0.0167	0.1504***	0.1705***	0.1573***	0.1524**	0.0706**	0.0724*	0.0662**
	(0.0290)	(0.0225)	(0.0216)	(0.0382)	(0.0312)	(0.0380)	(0.0608)	(0.0290)	(0.0390)	(0.0296)
Distance	-1.2092***	-0.8925***	-1.5588***	-1.5181***	-1.4877***	-1.3451***	-1.1773***	-1.6172***	-1.5956***	-1.7471***
	(0.0321)	(0.0333)	(0.0357)	(0.0435)	(0.0410)	(0.0577)	(0.0963)	(0.0395)	(0.0495)	(0.0463)
Language	1.1863***	1.0951***	1.1545***	0.9582***	0.9502***	1.1303***	0.7785***	0.8627***	0.9123***	0.9368***
	(0.0958)	(0.0876)	(0.0858)	(0.0883)	(0.0847)	(0.1072)	(0.1874)	(0.0843)	(0.1010)	(0.0896)
PTAs	-0.0663	-0.0257	-0.0917	0.2220**	0.2220**	-0.0415	3.2778***	0.2624***	-0.3000***	-0.0326
	(0.0786)	(0.0696)	(0.0775)	(0.0967)	(0.0881)	(0.1243)	(0.2640)	(0.0812)	(0.1093)	(0.0978)
Destination Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Source Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	4833	4798	4857	4573	4639	4041	2156	4627	4235	4261
F stat	223.95	281.58	259.03	239.28	171.15	129.3	28.33	177.12	147.99	170.57
Prob > F stat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R squared	0.82	0.86	0.83	0.82	0.75	0.71	0.58	0.79	0.76	0.79

Table 4 continued

	Rubber products	Pottery China	Non-metallic products	Iron and Steel	Non-ferrous metals	Fabricated metal products	Machinery, non-electrical	Machinery, electrical	Transport equipment	Other manufactured goods	Industrial Chemicals	Petroleum coal products
Linder term	-0.0095	-0.0022	0.0020	0.0247	-0.0091	0.0690***	0.0103	0.0472**	0.0501	0.0451*	-0.0158	0.0497
	(0.0223)	(0.0242)	(0.0298)	(0.0317)	(0.0375)	(0.0224)	(0.0195)	(0.0241)	(0.0334)	(0.0234)	(0.0235)	(0.0521)
Distance	-1.4772***	-1.5558***	-1.6113***	-1.7905***	-1.7270***	-1.4452***	-1.1333***	-1.0753***	-1.2720***	-1.1742***	-1.4000***	-1.1681***
	(0.0381)	(0.0405)	(0.0436)	(0.0478)	(0.0515)	(0.0356)	(0.0280)	(0.0345)	(0.0436)	(0.0354)	(0.0319)	(0.0807)
Langauge	1.0561***	1.0717***	1.1009***	0.7003***	0.9662***	1.0866***	1.0675***	1.0804***	0.9866***	1.2355***	0.6317***	0.6681***
	(0.1011)	(0.0995)	(0.1025)	(0.0964)	(0.1064)	(0.0854)	(0.0728)	(0.0880)	(0.0940)	(0.0919)	(0.0828)	(0.1535)
PTAs	0.6833***	-0.0415	-0.1461	0.2512**	-0.1842	-0.2800***	-0.2829***	0.0119	0.6270***	-0.1545*	-0.1005	-0.0400
	(0.0876)	(0.0890)	(0.1004)	(0.1020)	(0.1158)	(0.0745)	(0.0616)	(0.0752)	(0.0996)	(0.0828)	(0.0694)	(0.1914)
Destination Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Source Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	4571	4599	4294	4381	4212	4716	4880	4824	4650	4685	4751	2913
F stat	190.91	175.02	144.98	135.57	132.46	250.18	326.19	255.01	180.96	257.2	251.83	48.91
Prob > F stat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R squared	0.8	0.79	0.76	0.76	0.74	0.83	0.87	0.84	0.78	0.84	0.84	0.54

Robust standard errors are presented in parentheses. ***, **, * denote significance at 1, 5 and 10 percent level, respectively.

Table 5. Gravity Estimations Using Trademark Residuals as Measure of Exporter Quality

	Other Chemicals	Professional and Scientific Equip.	Paper and Printing	Wearing Apparel, Footwear	Food products	Beverages	Tobacco	Textiles	Leather products	Furniture	Rubber products
Linder Term	0.027***	0.014***	0.010***	0.017***	0.025***	0.028***	0.006	0.006**	0.005	0.002	0.010***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.007)	(0.003)	(0.004)	(0.003)	(0.003)
ln Distance	-1.202***	-0.880***	-1.398***	-1.541***	-1.480***	-1.395***	-1.167***	-1.627***	-1.569***	-1.671***	-1.331***
	(0.029)	(0.031)	(0.036)	(0.050)	(0.041)	(0.058)	(0.116)	(0.039)	(0.057)	(0.048)	(0.040)
Language Dummy	1.164***	0.985***	1.201***	0.955***	0.800***	1.106***	0.602***	0.840***	0.933***	1.028***	1.005***
	(0.080)	(0.080)	(0.081)	(0.095)	(0.083)	(0.107)	(0.223)	(0.092)	(0.124)	(0.104)	(0.110)
Preferential Trade	0.129	-0.015	0.258***	0.274**	0.490***	0.209	3.316***	0.210**	-0.169	0.085	0.665***
Agreement	(0.081)	(0.069)	(0.085)	(0.111)	(0.100)	(0.147)	(0.307)	(0.102)	(0.137)	(0.110)	(0.111)
Constant	13.561***	10.083***	13.833***	13.434***	19.671***	15.183***	10.459***	17.667***	12.887***	15.641***	11.827***
	(0.344)	(0.357)	(0.474)	(0.633)	(0.544)	(0.688)	(1.284)	(0.528)	(1.100)	(0.559)	(0.565)
Number of obs.	3511	3318	2837	2962	3073	2695	1405	2440	2238	2129	2100
F stat	200.99	232.51	197.89	157.1	134.45	72.25	17.72	119.49	82.19	117.13	103.25
Prob > F stat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.84	0.87	0.87	0.83	0.79	0.73	0.57	0.82	0.79	0.84	0.83
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Destination Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Source Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Table 5 continued

	Pottery China	Non-metallic Mineral	Iron and Steel	Non-ferrous metals	Fabricated Metal	Machinery Non-electrical	Machinery Electric	Transport	Other Manufactured products	Industrial Chemicals	Petroleum Coal
Linder Term	0.002	0.007**	0.003	0.004	0.012***	0.007***	0.003	0.009***	0.002	0.014***	0.019***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.007)
ln Distance	-1.444***	-1.541***	-1.722***	-1.635***	-1.361***	-1.043***	-1.013***	-1.133***	-1.198***	-1.374***	-1.328***
	(0.042)	(0.042)	(0.049)	(0.054)	(0.044)	(0.026)	(0.032)	(0.046)	(0.036)	(0.032)	(0.090)
Language Dummy	1.091***	1.103***	0.605***	0.745***	1.066***	0.930***	0.987***	1.012***	1.054***	0.710***	0.730***
	(0.109)	(0.107)	(0.091)	(0.124)	(0.096)	(0.068)	(0.084)	(0.104)	(0.101)	(0.077)	(0.170)
Preferential Trade	0.190*	0.173	0.333***	0.332**	0.022	-0.079	0.043	0.865***	-0.221**	0.139*	-0.235
Agreement	(0.109)	(0.122)	(0.115)	(0.140)	(0.117)	(0.069)	(0.087)	(0.114)	(0.097)	(0.078)	(0.242)
Constant	13.235***	13.248***	15.046***	15.703***	12.518***	11.936***	11.378***	12.420***	11.972***	14.298***	8.785***
	(0.668)	(0.720)	(0.670)	(0.889)	(0.640)	(0.471)	(0.553)	(0.809)	(0.499)	(0.544)	(1.861)
Nr. Observations	2228	2163	2290	2091	1864	2745	2624	2553	2530	2745	1570
F stat	108.85	78.63	96.02	96.99	151.39	232.86	168.78	119.77	150.54	180.65	23.12
Prob > F stat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.82	0.79	0.81	0.8	0.85	0.9	0.86	0.8	0.86	0.86	0.61
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Destination Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Source Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors are presented in parentheses. ***, **, * denote significance at 1, 5 and 10 percent level, respectively.